

DCA09FR008  
Lake Buena Vista, Florida  
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User Guide  
Epcot Switch Beam  
Panel Operation

# Monorail Epcot Loop PDMS Upgrade

## User Guide



**DRAFT**  
**December 01, 2007**  
***For Training Purposes Only***  
***(Final version to be included in maintenance manual)***

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## **1 System Overview**

The Epcot Loop PDMS (Power Distribution and Monitoring System) provides monitoring and control functions to the utility power system supplying power to the beam bus rail. The system monitors and controls the various breakers, contactors, and sensors in the Rectifier and Lineup buildings, the Epcot Station, TTC Concourse Station, and the Switchbeam 8 & 9 Controller. The Transfer Trip System is an independent system that provides monitoring and control of the Lineup power contactors feeding the bus.

The new system design incorporates enhancements to the functionality and reliability of the system. The system operates over two distributed fiber optic networks. There is a separate network for the PDMS system and the Transfer Trip System. Each network consists of two fiber paths configured in a redundant self-healing ring. The processors communicate over the fiber optic network using the Allen Bradley Controlnet protocol.

The control hardware is based on the Allen Bradley Contrologix platform. Each enclosure contains the Contrologix rack containing digital input and isolated digital output modules, Controlnet communications modules, and a fiber optic modem. The fiber modem converts the Controlnet communications for use over the fiber optic network.

The operator performs all system functions through the touchscreen interface located in the Monorail Roundhouse. There are no local operator controls in the field enclosures.

If the PDMS system fails to operate, the lineup and rectifiers will continue to operate normally, remaining in the last commanded state. In the event of a system failure, operation of the lineups or rectifiers requires manual intervention by a technician. PDMS outputs could fail in an ON state, disabling certain manual functions.

## **1.1 Main Roundhouse Console**

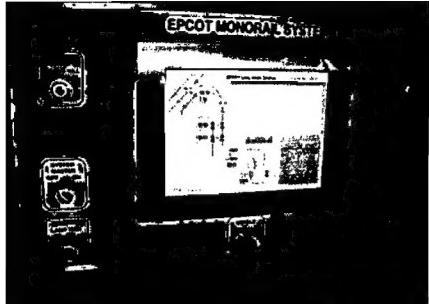


Figure 1 - Operator Console "EPRD"

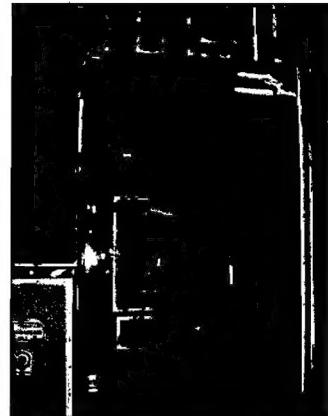


Figure 2 - Gateway Cabinet - "EP12"

## **1.2 Lineup Enclosure (Typical)**

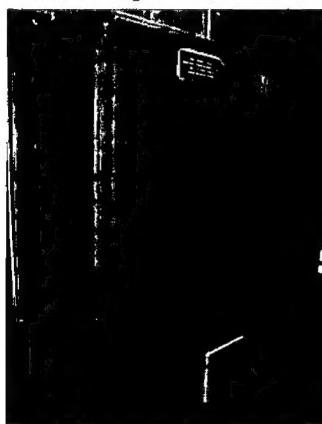


Figure 3 - Typical Lineup Exterior

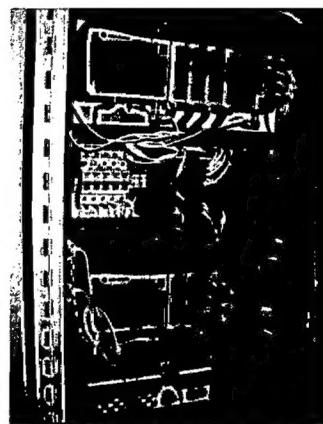


Figure 4 - Typical Lineup Interior

## **1.3 Rectifier Enclosure (Typical – Except Rectifier 1)**

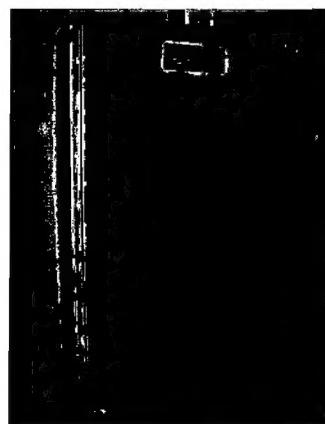


Figure 5 - Typical Rectifier Exterior

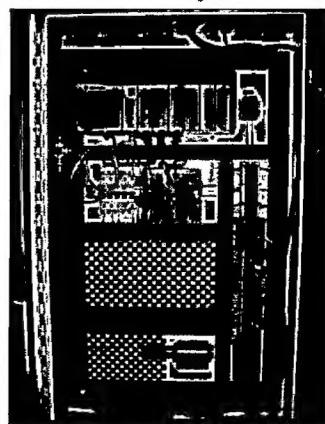


Figure 6 - Typical Rectifier Interior

#### **1.4 TTC Station Enclosure**

Insert photo of enclosure

#### **1.5 Epcot Station Enclosure**

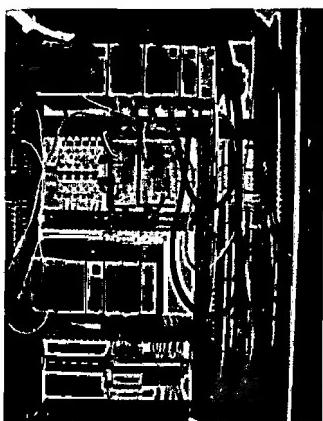
Insert photo of enclosure

#### **1.6 Switchbeam Enclosure**



**Figure 7 - Switchbeam 8 & 9 Enclosure**

#### **1.7 Rectifier 1/Switchbeam Interface Enclosure**



**Figure 8 - Rectifier 1 / Switchbeam Interface Enclosure**

## **2 System Operation**

The PDMS is controlled through hardware switches and buttons, and a touchscreen interface located in the Monorail Roundhouse. The touchscreen provides “soft” switches to control functions, multi-color status indicators to show the various system states, and a messaging log to provide the operator with pertinent system malfunctions that require intervention. An audible alarm and strobe light provide indication of new alarms to the operator.

### ***2.1 Console Switches***

#### **2.1.1 Epcot System Kill**



The Epcot System Kill button removes power from the monorail beam by dropping out all Lineup contactors and Rectifier breakers.

#### **2.1.2 Switchbeam Kill**



The Switchbeam Kill button removes power from the Switchbeam only, and stops movement if the beam is in motion.

#### **2.1.3 System Master**



The System Master switch enables all output and control functions. This switch must be on to enable any control functions.

The System Master also acts as a “Night-Mode” selector for the audible alarm. After normal operation for the day, the System Master can be placed in the OFF position. If there are no beams energized with the System Master in the OFF position, any new alarms will sound the audible alarm for 5 seconds and then automatically silence. The strobe continues to flash until the alarm is acknowledged by the operator. If power is applied to any beam, new alarms cause the audible alarm to continue sounding until acknowledged by the operator, regardless of the position of the System Master switch.

#### **2.1.4 Enable**



The Enable button allows access to touchscreen functions, excluding any Switchbeam functions.

### **2.1.5 Switchbeam Enable**



The Switchbeam Enable button allows access to the touchscreen Switchbeam control functions only.

### **2.1.6 Alarm Silence**



The Alarm Silence button silences the audible alarm when pushed momentarily, and acknowledges latched faults when pushed and held for approximately 3 seconds.

### **2.1.7 Lamp Test**



The Lamp Test button activates all console audible and visual indicators for test purposes.

## 2.2 Touchscreen Interface

### 2.2.1 Monitoring System Status

The PDMS touchscreen display provides several visual displays of the system status. Table 1 describes each of the symbols and their states.

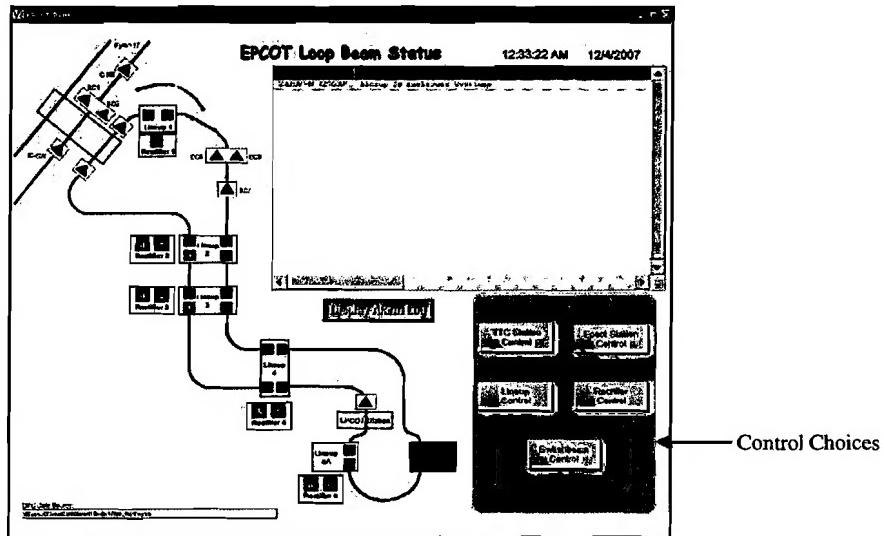
**Table 1**

Icon	Description	Color	Status
	Beamway		De-Energized "Cold"
			Energized "Hot"
	Lineup Building	White	No Faults
			Fault Present (See Active Alarms for specific fault)
	Lineup Contactor		De-Energized
			Energized
			Manual Lockout
	Rectifier Building	White	No Faults
			Fault Present (See Active Alarms for specific fault)
	Rectifier Breaker		De-Energized
			Energized
	Bridge Contactor		De-Energized
			Energized

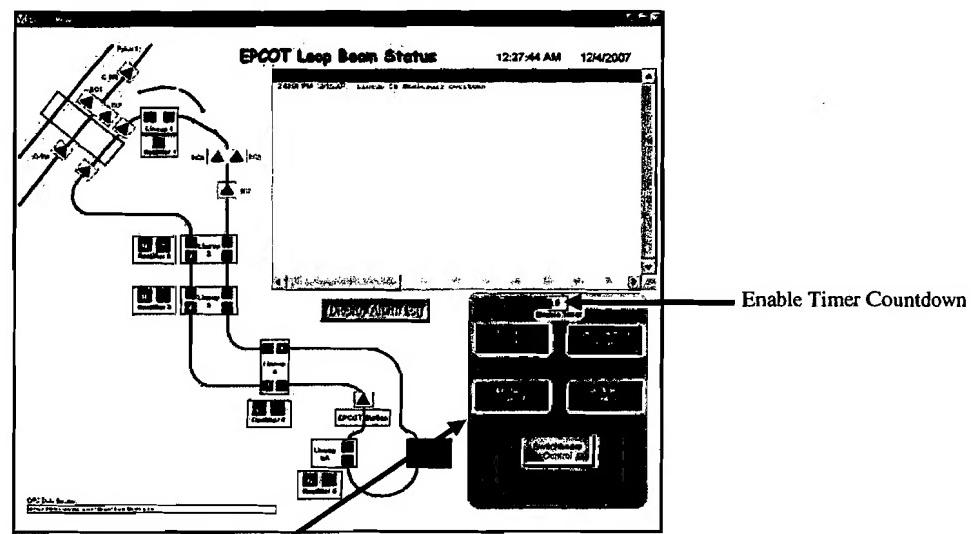
## 2.2.2 Controlling Zones

### 2.2.2.1 Energizing a Zone

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

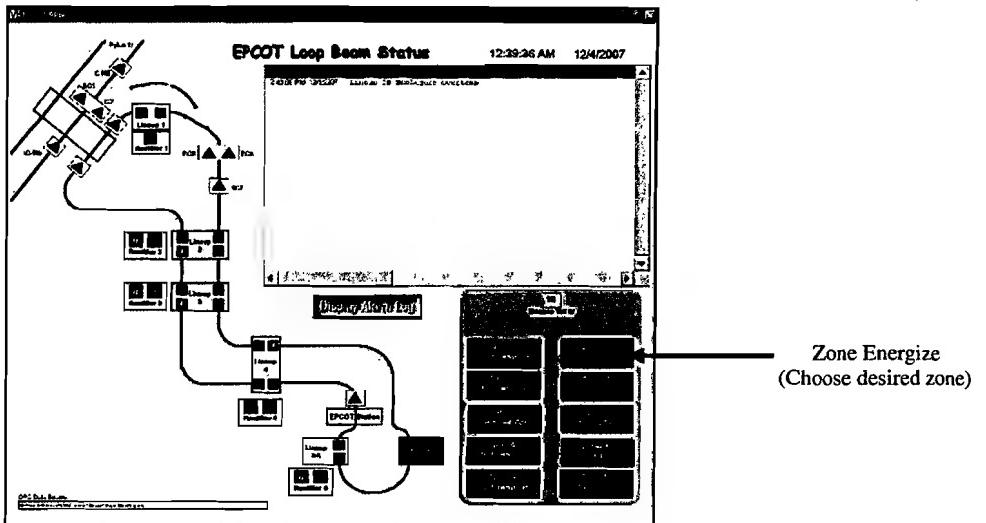


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.

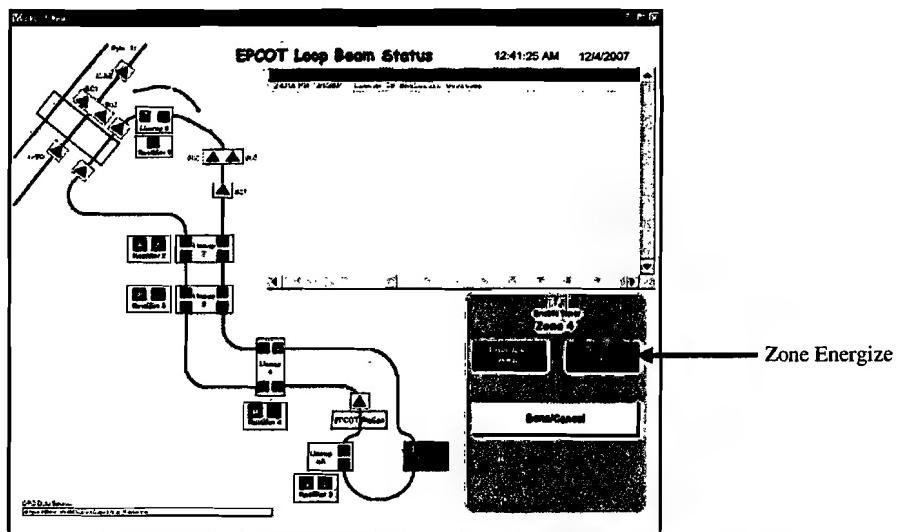


3. Press the Lineup Control button.

4. Select the desired Zone to energize.



5. Select “Energize East” or “Energize West” (There is only one Zone for Zone 5)

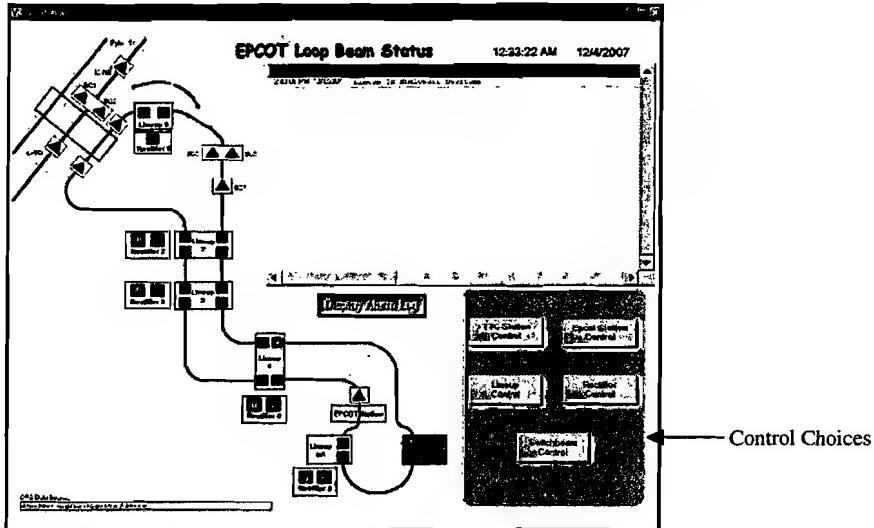


#### NOTES

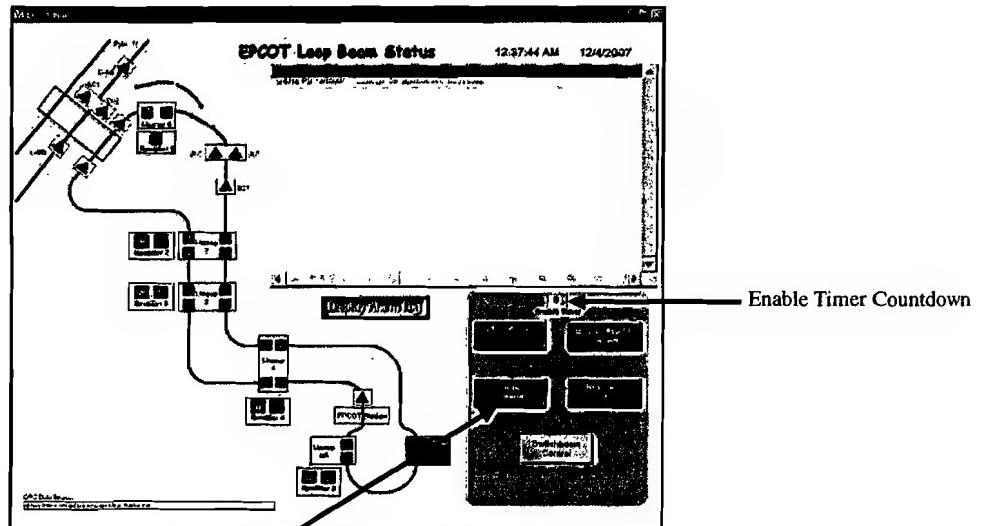
- Once a zone is selected, you can energize both East and West up until the timer expires.
- After pressing the “Energize East” or “Energize West” button, the zone is energized. There is a time delay before the screen will show the zone “Hot” due to the contactor pulling in.
- Once you have pressed the appropriate energize button, you may either press the “Done” button or wait for the timer to expire to return to the main screen.

### **2.2.2.2 De-Energizing a Zone**

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

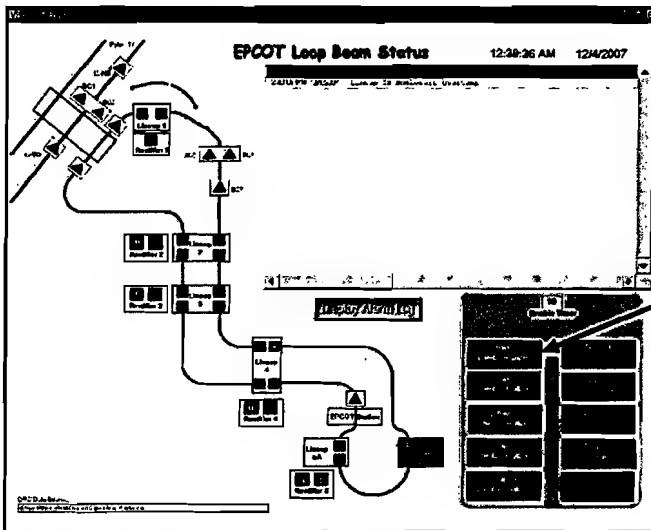


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.

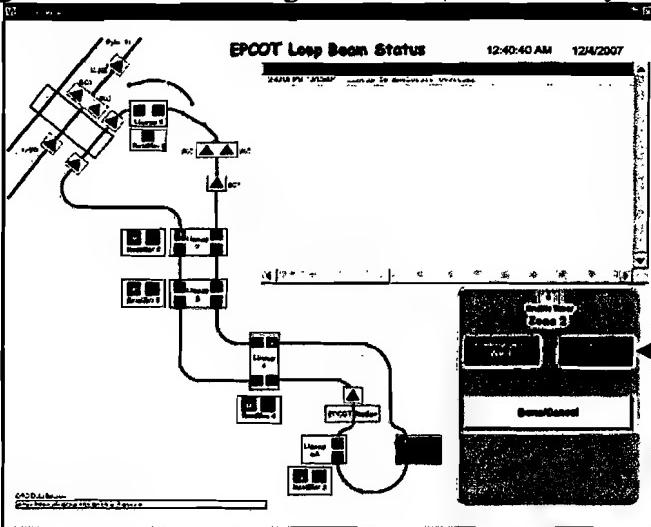


3. Press the Lineup Control button.

4. Select the Zone to de-energize.



5. Select "De-Energize East" or De-Energize West" (There is only one Zone for Zone 5)



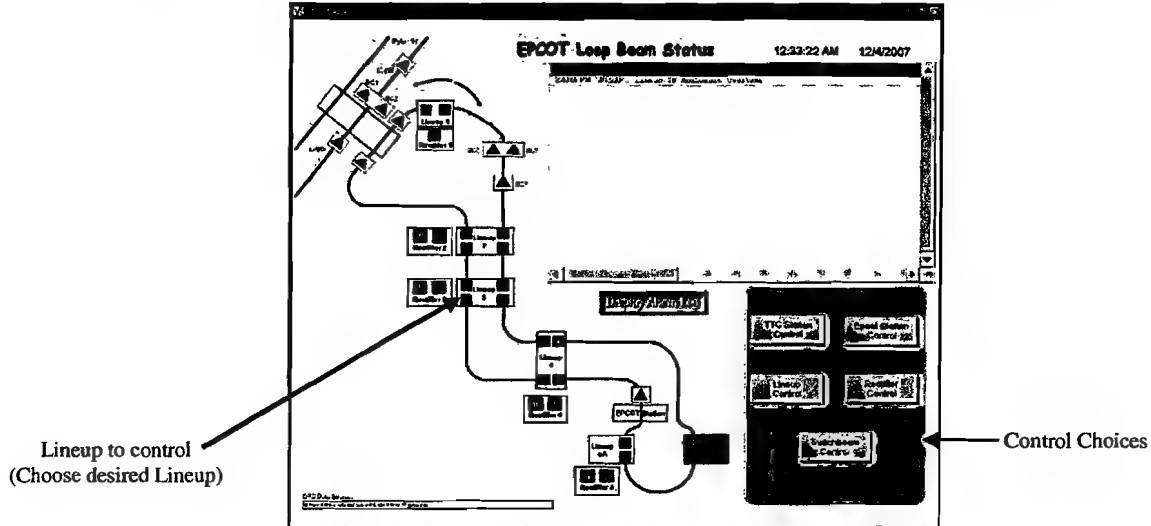
#### NOTES

- Once a zone is selected, you can de-energize both East and West up until the timer expires.
- After pressing the "De-Energize East" or "De-Energize West" button, the zone is de-energized. The screen will show the zone "Cold" immediately.

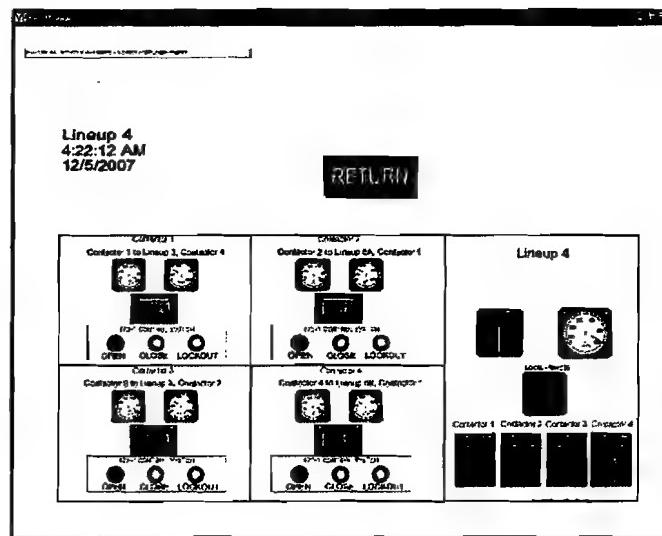
## 2.2.3 Controlling Lineups (Individual Contactors)

### 2.2.3.1 Energizing a Lineup Contactor

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

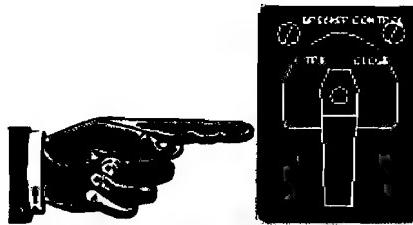


2. Select the desired Lineup to energize by touching it on the track map. The screen will change to the contactor control screen.

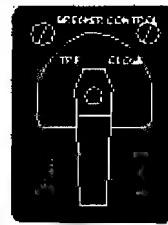


3. Push the ENABLE button.
4. Select the contactor to energize (the indicator will be green)

5. Touch the contactor “handle”

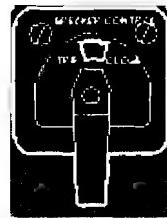


6. The colored background will blink while it energizes.
7. The contactor has pulled in when the indicator turns red.



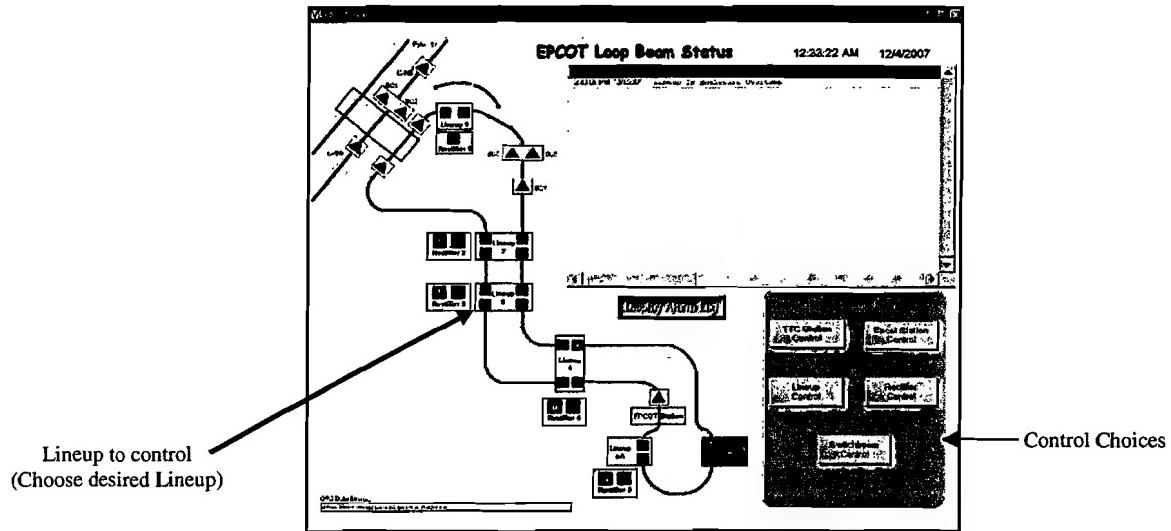
#### NOTES

- Once a lineup is selected, you can energize any or all of the contactors up until the timer expires.
- After pressing the contactor “handle” button, the contactor is energized. There is a time delay before the screen will show the contactor “Hot” due to the contactor pulling in.
- If a contactor is manually locked out, the handle will have a yellow indicator.

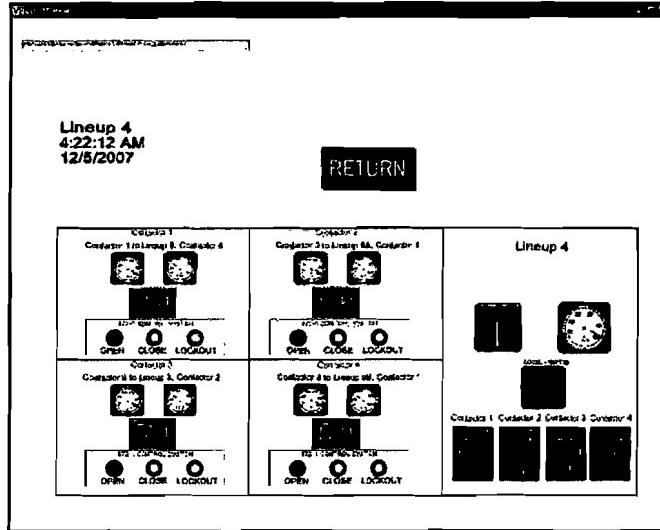


### 2.2.3.2 De-Energizing a Lineup Contactor

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

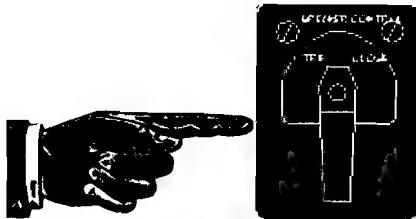


2. Select the Lineup to de-energize by touching it on the track map. The screen will change to the contactor control screen.

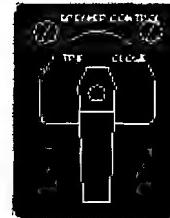


3. Push the ENABLE button.
4. Select the contactor to de-energize (the indicator will be red)

5. Touch the contactor “handle”



6. The colored background will blink while it de-energizes.
7. The contactor has pulled in when the indicator turns green.



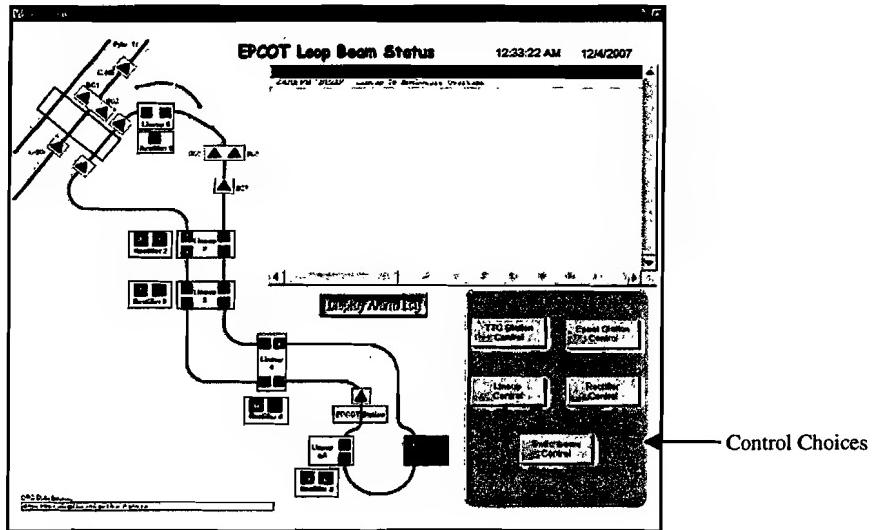
#### NOTES

- Once a lineup is selected, you can de-energize any or all of the contactors up until the timer expires.
- After pressing the contactor “handle” button, the zone is de-energized. The screen will show the zone “Cold” immediately.

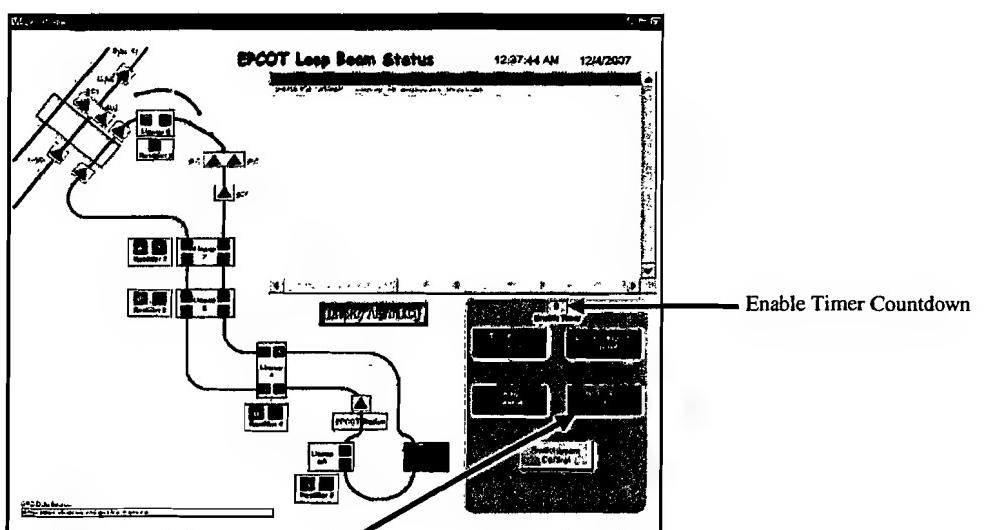
## 2.2.4 Controlling Rectifiers

### 2.2.4.1 Energizing a Rectifier

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

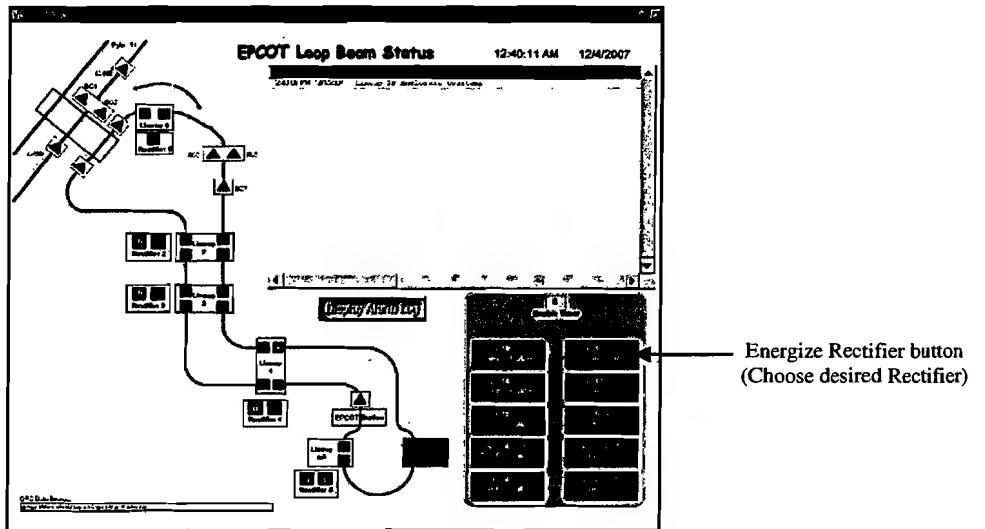


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.

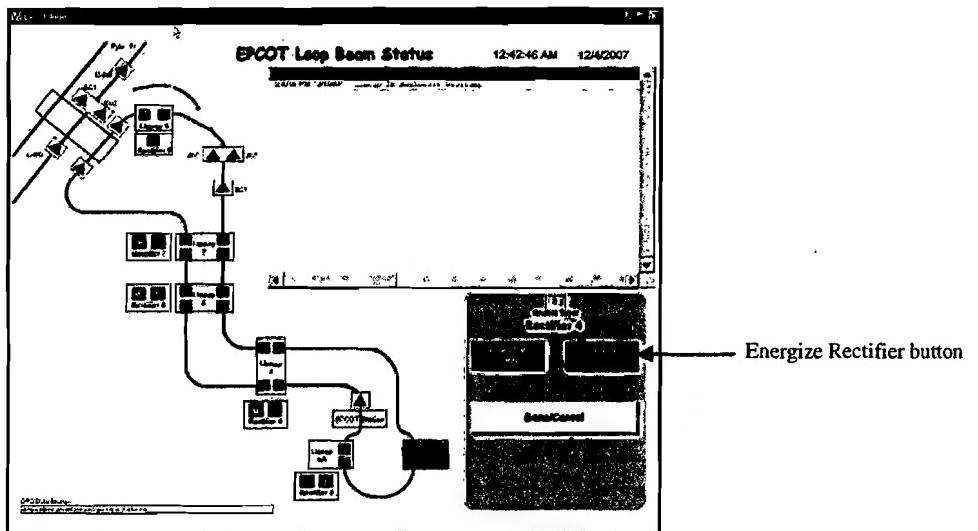


3. Press the "Rectifier Control" button

4. Select the Rectifier to energize.



5. Select “Energize East” or “Energize West” (There is only one for Rectifier 1)

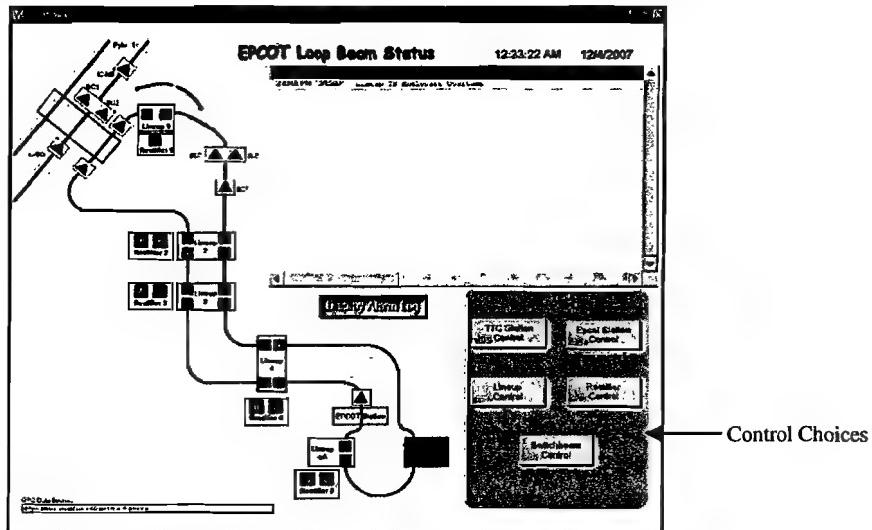


#### NOTES

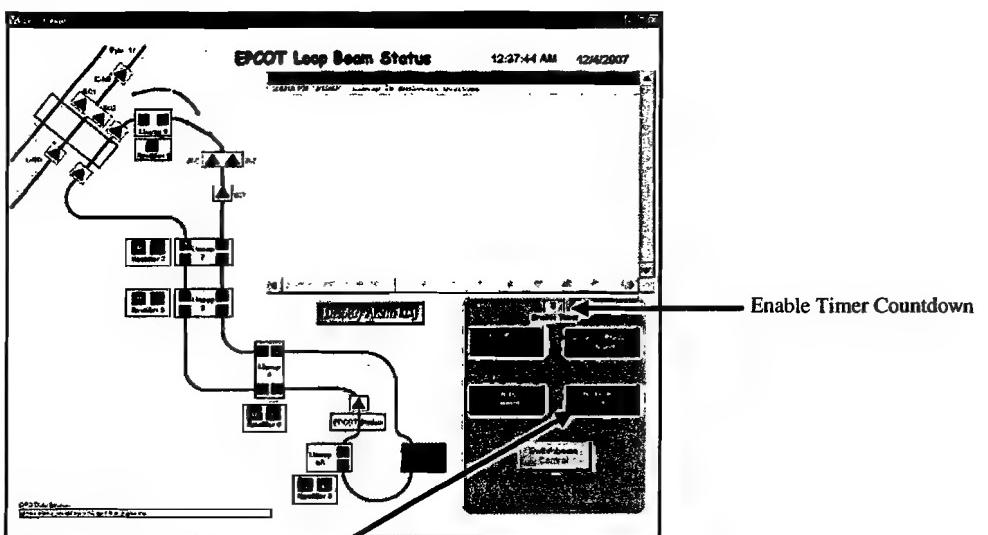
- Once a Rectifier is selected, you can energize both East and West up until the timer expires.
- After pressing the “Energize East” or “Energize West” button, the rectifier is energized. There is a time delay before the screen will show the rectifier “Hot” due to the contactor pulling in.
- Once you have pressed the appropriate energize button, you may either press the “Done” button or wait for the timer to expire to return to the main screen.

#### 2.2.4.2 De-Energizing a Rectifier

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

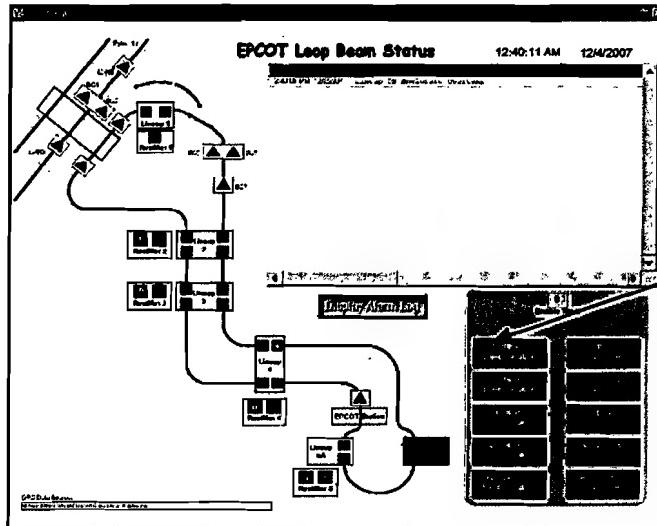


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



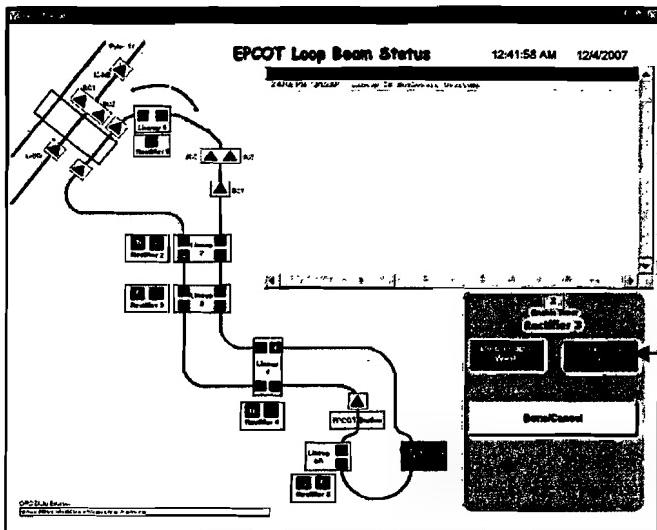
3. Press the Rectifier Control button.

4. Select the Rectifier to de-energize.



De-Energize Rectifier button  
(Choose desired Rectifier)

5. Select “De-Energize East” or De-Energize West” (There is only one for Rectifier 1)



De-Energize Rectifier button

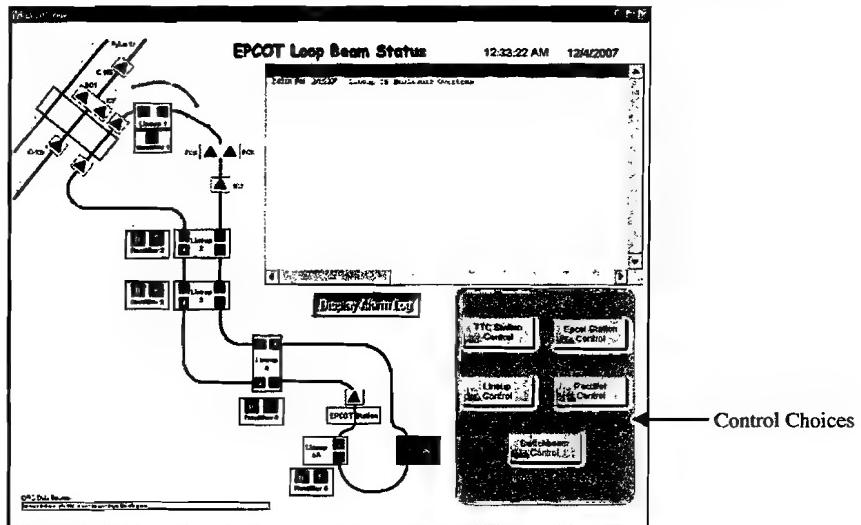
## NOTES

- Once a rectifier is selected, you can de-energize both East and West up until the timer expires.
- After pressing the “De-Energize East” or “De-Energize West” button, the rectifier is de-energized. The screen will show the zone “Cold” immediately.

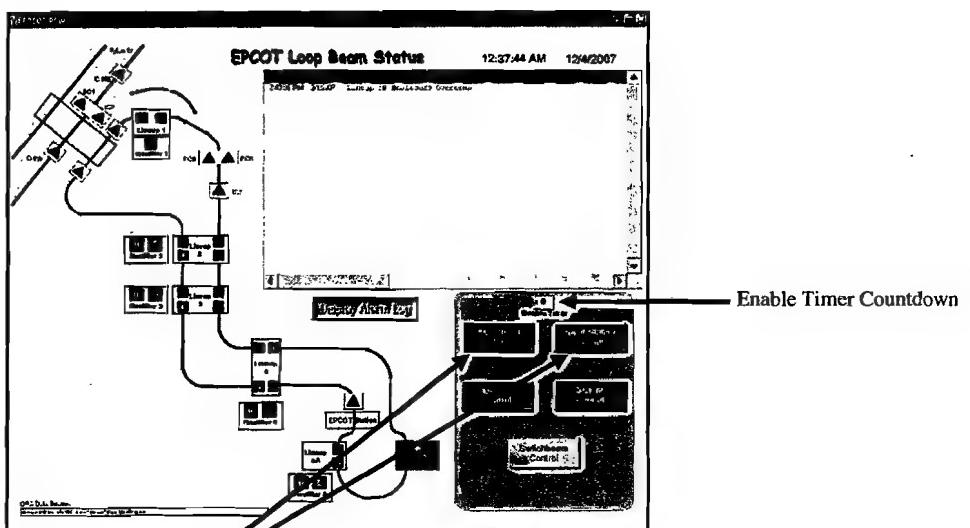
## 2.2.5 Controlling Stations

### 2.2.5.1 Energizing a Station

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

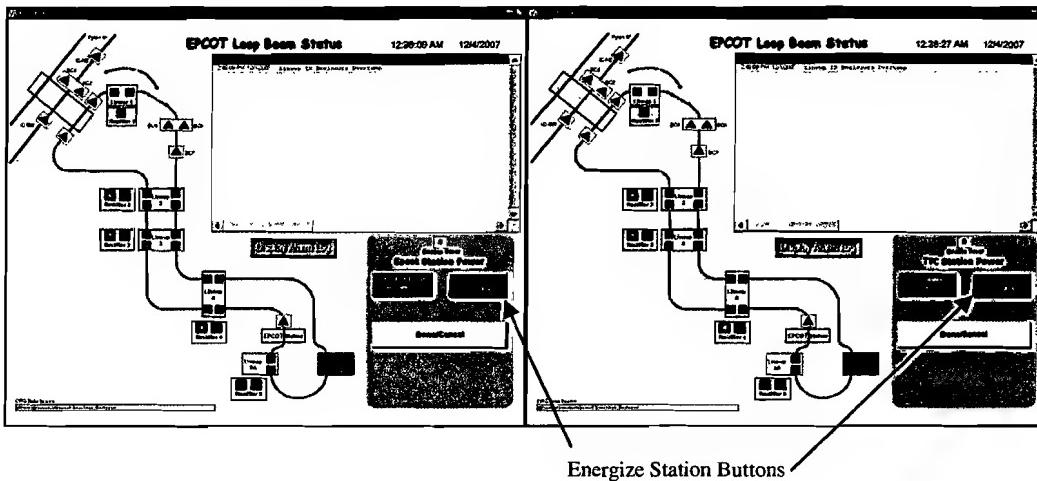


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



3. Select the Station to energize.

4. Press the “Epcot Station Energize” or “TTC Station Energize”

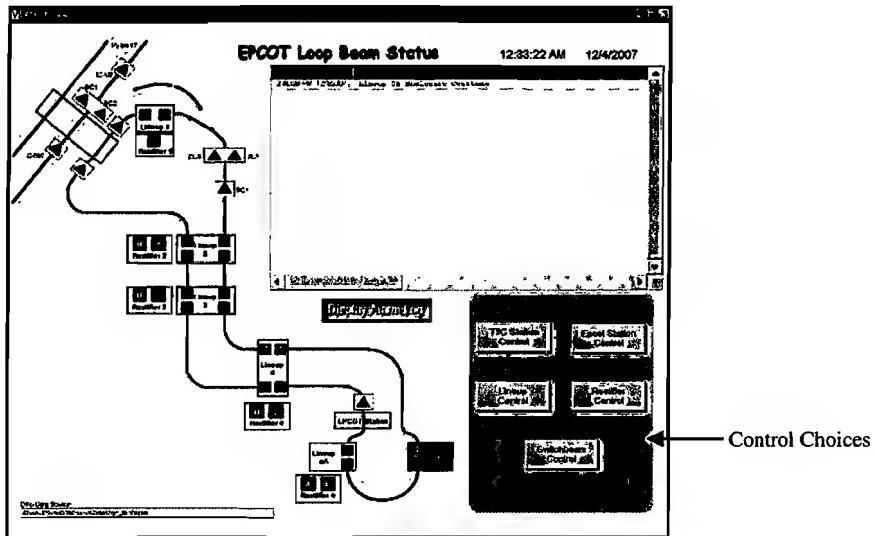


## NOTES

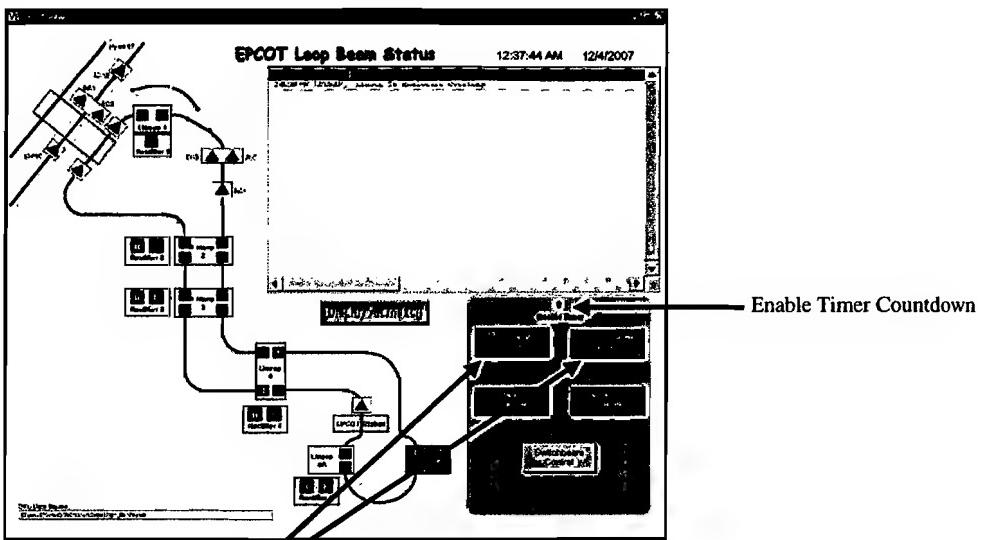
- The Station Kill Switches MUST be in the UP position to allow remote energizing of the station.
- After pressing the “Energize” button, the Station is energized. There is a time delay before the screen will show the Station “Hot” due to the contactor pulling in.
- Once you have pressed the appropriate energize button, you may either press the “Done” button or wait for the timer to expire to return to the main screen.

### **2.2.5.2 De-Energizing a Station**

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

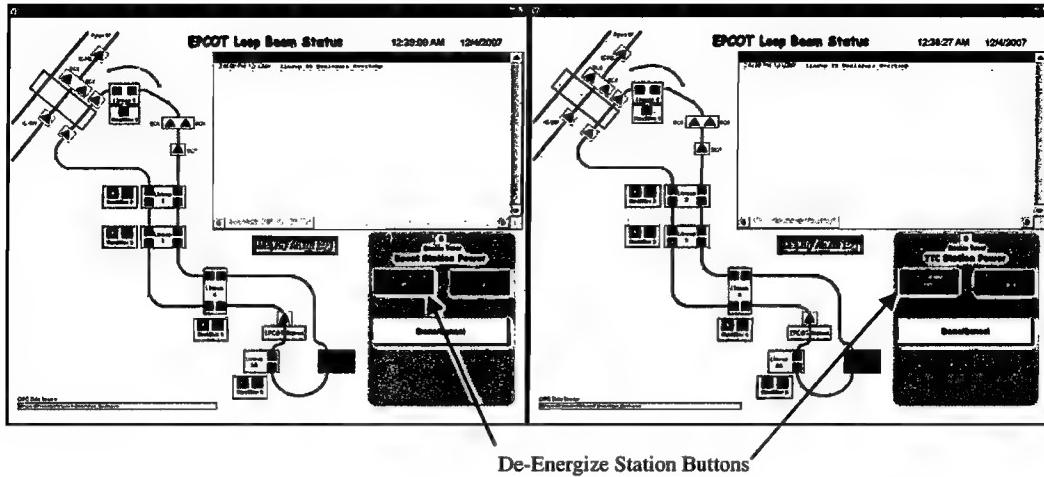


2. Push the ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



- ### **3. Select the station to De-Energize.**

4. Press the “Epcot Station De-Energize” or “TTC Station De-Energize”.



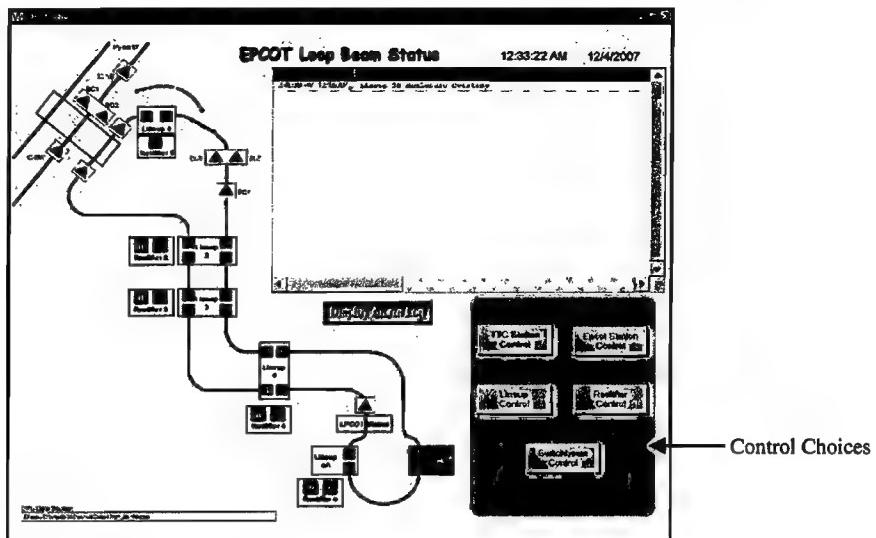
#### NOTES

- After pressing the “De-Energize” button, the Station is de-energized. The screen will show the Station “Cold” immediately.

## 2.2.6 Controlling Switchbeams

### 2.2.6.1 Moving a Switchbeam

1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.



2. Cycle the Switchbeam Kill switch down and back up (This is only necessary the first time the System Master is turned on when moving Switchbeams. Additional moves can be accomplished without cycling the System Master switch. If the System Master is turned off, the Switchbeam Kill will need to be cycled again.)

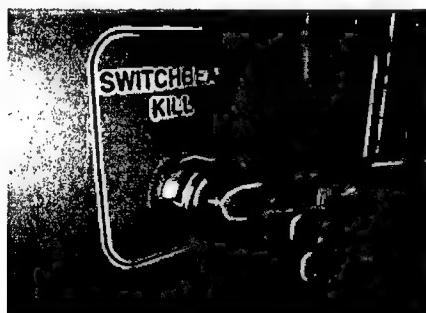


Figure 9 - Push the Switchbeam Kill down to reset

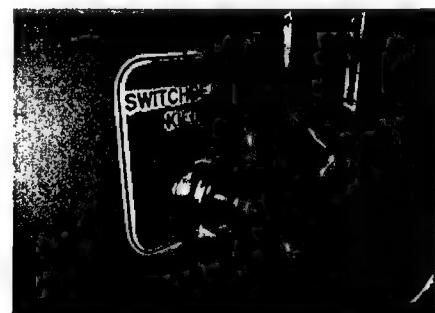
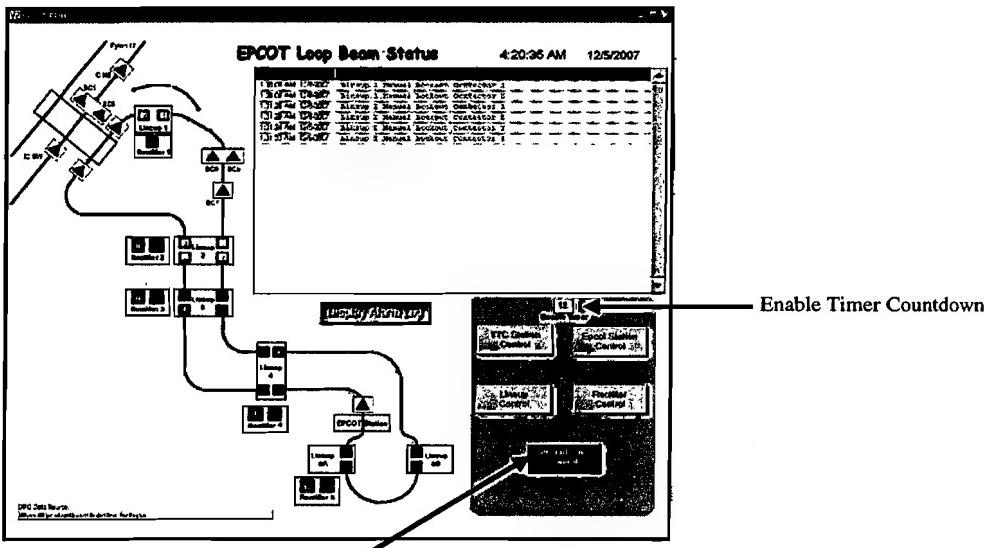
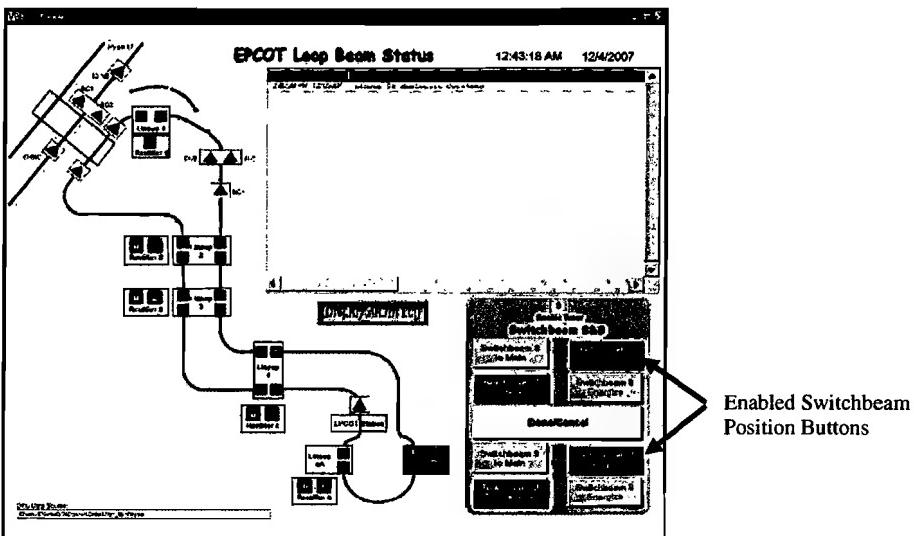


Figure 10 - Pull the Switchbeam Kill up to enable further actions

3. Push the SWITCHBEAM ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



4. Press the “Switchbeam Control” button
  5. Select the Switchbeam to move. (Only the button for the position that is available to move to will be highlighted. The current position will be grayed out.)



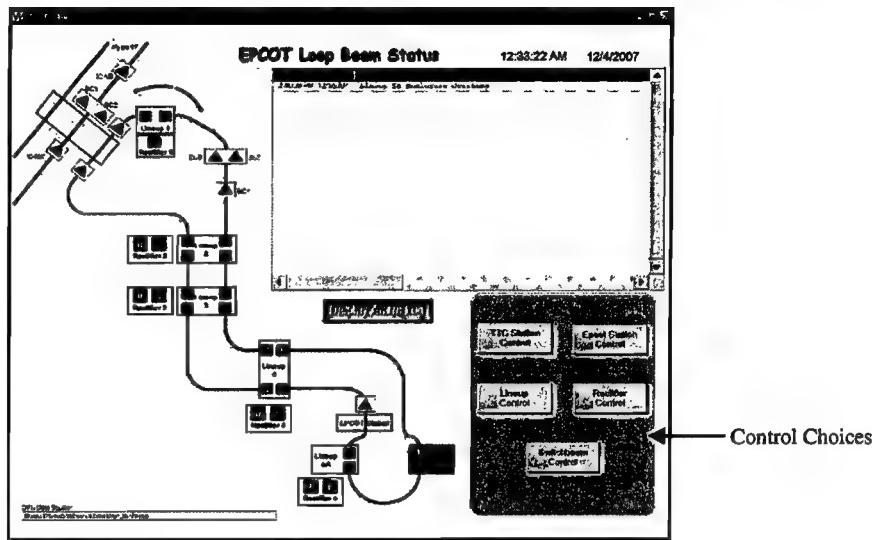
## NOTES

- Once Switchbeam control is selected, you can move either or both Switchbeams up until the timer expire.
  - After pressing the Switchbeam position button, the Switchbeam begins moving. There is a time delay before the screen will show the Switchbeam in its new position. The beam will flash on the screen while it is in motion.

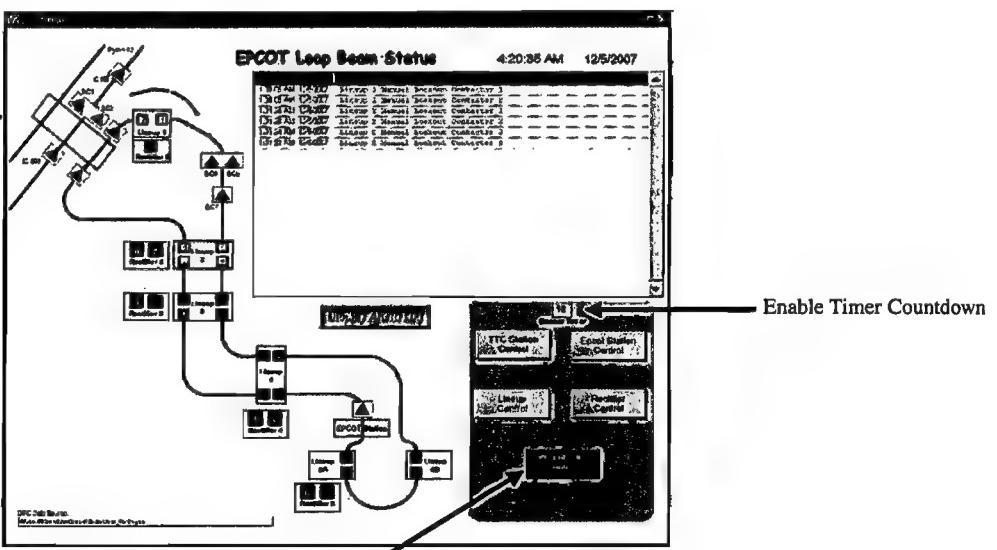
- Once you have pressed the appropriate Switchbeam move button, you may either press the “Done” button or wait for the timer to expire to return to the main screen.

### 2.2.6.2 Energizing a Switchbeam

- Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.

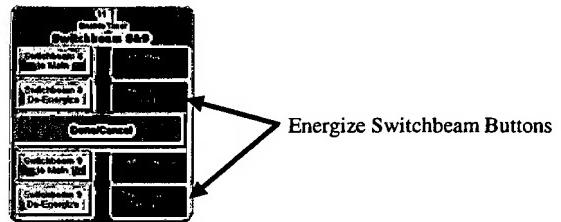


- Push the SWITCHBEAM ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



- Press the “Switchbeam Control” button

4. Select the Switchbeam to energize.

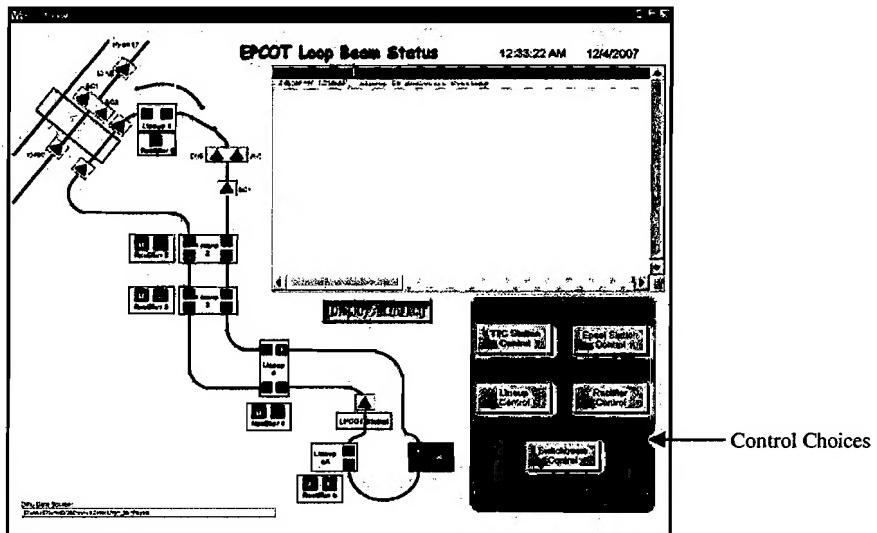


## NOTES

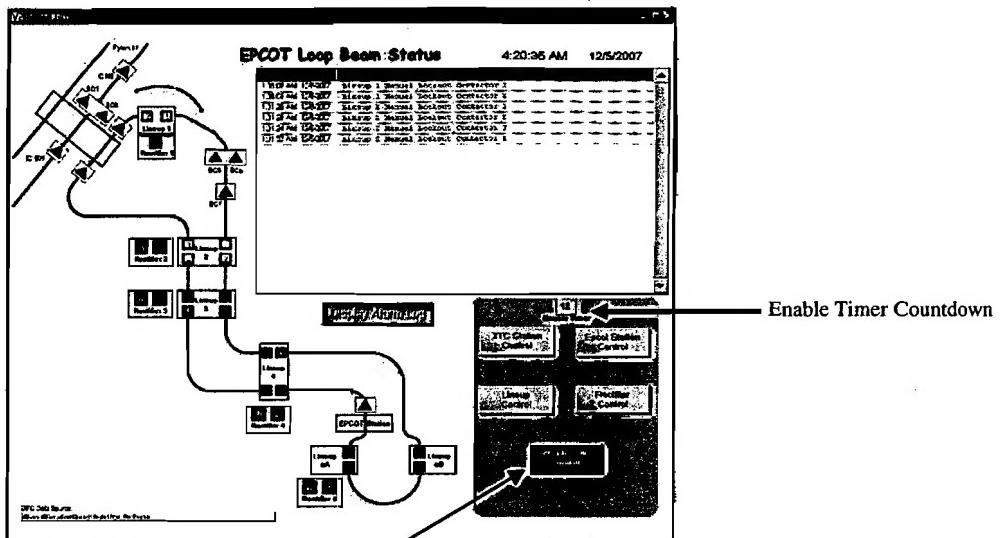
- Once Switchbeam Control is selected, you can energize either or both Switchbeams up until the timer expires.
- After pressing the “Energize” button, the Switchbeam is energized. There is a time delay before the screen will show the Station “Hot” due to the contactor pulling in.
- Once you have pressed the appropriate energize button, you may either press the “Done” button or wait for the timer to expire to return to the main screen.

### 2.2.6.3 De-Energizing a Switchbeam

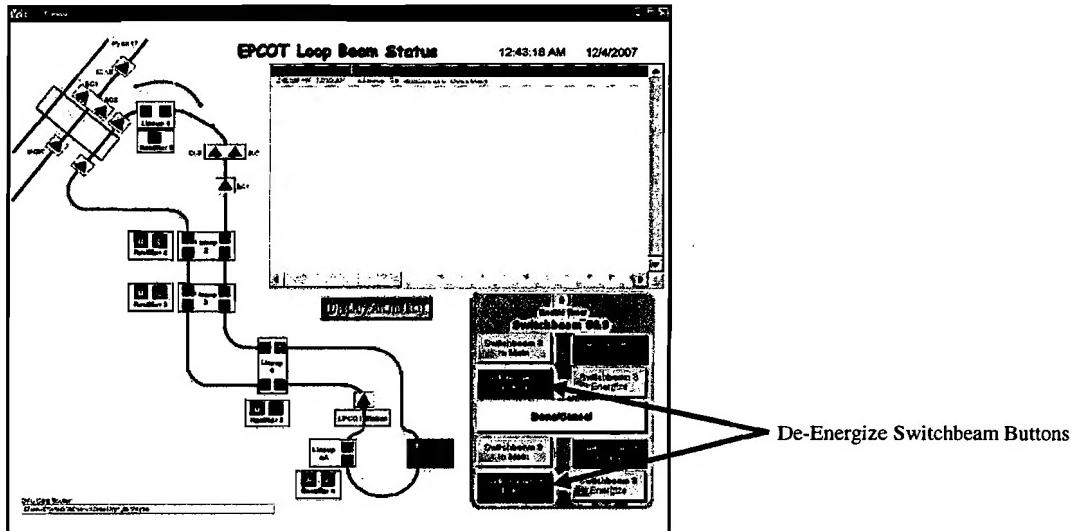
1. Turn the SYSTEM MASTER switch ON. Control choices are still grayed out.



- Push the SWITCHBEAM ENABLE button. Screen changes to show enabled choices. Timer begins 15-second countdown.



- Press the "Switchbeam Control" button
- Select the Switchbeam to de-energize.



## NOTES

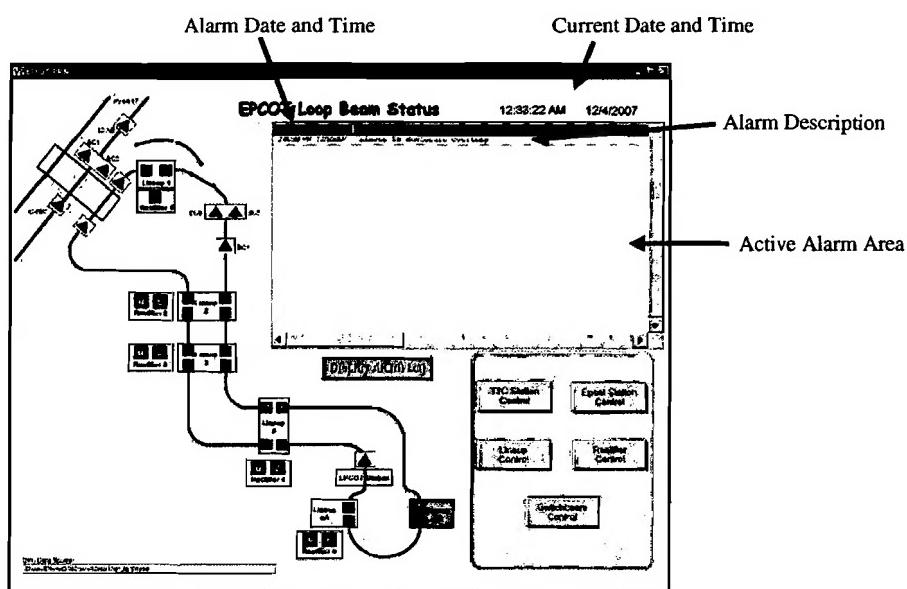
- Once Switchbeam Control is selected, you can de-energize either or both Switchbeams up until the timer expires.
- After pressing the "De-Energize" button, the Switchbeam is de-energized. The screen will show the Switchbeam "cold" immediately.
- Once you have pressed the appropriate de-energize button, you may either press the "Done" button or wait for the timer to expire to return to the main screen.

## **3 Messaging**

### **3.1 Active Alarms**

When an anomaly or malfunction occurs in the PDMS, Transfer Trip, or Switchbeam Controllers, the Active Alarm screen displays the specific error, the audible alarm activates, and the strobe flashes. Pushing the ALARM SILENCE button turns off the audible alarm for the current error. The text message and strobe will remain active as long as the fault condition is present.

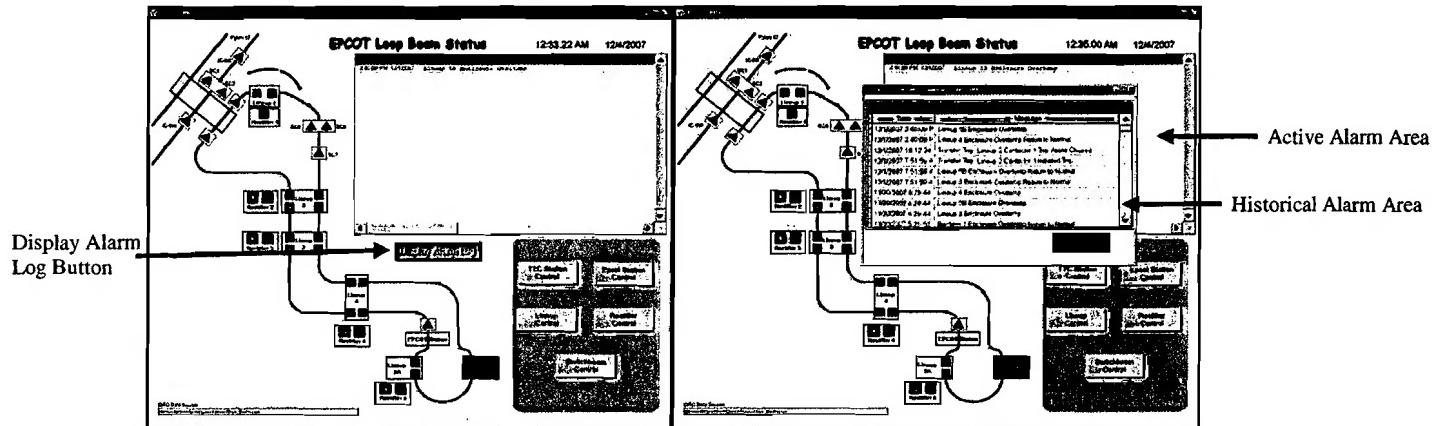
Several alarms are “Latched” alarms. Due to the momentary fault condition of these alarms, it is necessary to latch them in the processor so that the operator can identify the exact nature of the alarm. These alarms will NOT clear from the Active Alarm screen when the fault condition returns to normal. To clear the latched alarms, it is necessary to push and HOLD the ALARM SILENCE button for 5 seconds. This will clear the latched alarm provided the fault condition returned to normal. If the fault still exists, the message will NOT clear. Latched alarms include the DC Overcurrent Trip, Switchbeam, and Transfer Trip faults.



### **3.2 Historical Log**

Fault messages are stored in a database to provide historical access for the operator. Alarms are stored with the time and date of the fault. A separate message indicates when the fault returned to normal. The database stores errors by month, for the previous 12 months. Once the database reaches the twelfth month, it begins to write over the previous log.

To access the Historical Log, press the “Display Alarm Log” button on the touchscreen. A scroll bar on the right allows the messages to scroll up or down to find a specific error.



## **4 Troubleshooting**

The new PDMS provides enhanced operator interface capabilities, and an extensive error message system to aid in locating system faults. There are no special maintenance requirements for the system beyond ventilation filter cleaning and routine backup battery maintenance.

Use standard troubleshooting procedures to correct common lineup and rectifier faults.

Faults associated with the Allen Bradley Contrologix equipment produce error messages identifying specific location failures, down to the individual I/O card in the rack. Network errors also indicate specific node and fiber failures.